Study on Designition to Credit Appreciation System in Small-Medium Enterprises' Credit-Loan Market

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***Abstract*-Paper constructs the index systems of credit guarantee risk recognition system, aparantly from small-medium finance condition and non-finance condition perspective.And it also constructs credit guarantee risk recognition model by introduction mathematics function into risk recognition field, and fufils credit guarantee risk recognition system goals. It is very important to China small-medium credit guarantee profession persisting development.Which develops and deepens the risk theory of small-medium credit guarantee, and offers the important theorentical reference, possessing the very important theorrtical and practical significance.**

Keywords-Small-Medium Enterprise;Credit-Loan Market; Credit ; Appreciation; System

I. INTRODUCTION

The negative impact of the global financial crisis in 2008 is unimaginable, and no previous financial crises are comparable with this one. The financial crisis exposed the vulnerability of commercial banks' inner structure, which needs to be pondered by commercial banks and financial regulatory authorities in all countries. It is also a significant warning to China that as a developing country, commercial banks have obvious inner frailty problem in their inner structures. The breakout of the financial crisis revealed the importance of prior risk management of credit projects to commercial banks all over the world which originally focused in mid and posterior risk management[1]. The financial implication of credit assessment proposed in this study is to conduct prior risk management to credit projects. This study suggests that the primary task of risk management of commercial banks is to conduct credit assessment to loan enterprises, and this is also applicable to Small and Medium Enterprises (SMEs). Only a complete and accurate credit assessment can lead to a reliable risk prevention and control[2]. Besides that, compared to large-sized enterprises SMEs have limitations in several factors such as their own size, management abilities and technologies; hence, the credit assessment system of large-sized enterprise can hardly reflect the real situation of SMEs credit assessment[3]. According to the results of credit assessment in credit market for SMEs, commercial banks will implement credit rationing for SMEs[4], which will give more credit markets to SMEs. This is because there is a significant information asymmetry in the process of the financial transactions in the financial markets. From a domestic view, there has to be a way to solve the adverse selection and moral hazard problems caused by the information asymmetry in financial market, in order to achieve the most optimal allocation of financial resources. Due to asymmetric information reasons, a rational choice of commercial banks is to implement credit rationing in the game with SMEs. Taking the phenomenon of credit rationing and its definition into account, SMEs with insufficient collateral and opaque information will probably be rationed out of credit market in order to avoid the adverse selection and moral hazard caused by information asymmetry, and this will eventually lead SMEs into financial difficulties[5]. With SMEs' rising contribution in social and economic development of China, to lead SMEs out of the financial plight has been an important task of China's financial system development in the developing period of 2011 to 2015. This study suggests that in order to solve SMEs' financing problem, it is a must to control the shortcomings caused by the credit rationing to SMEs implemented by commercial banks, and the only solution is to build a suitable credit assessment system for SMEs according to SMEs' characteristics. In such context, this study discusses the problem of "design of credit assessment system for SMEs' credit market". The main contributions of this study are:1. To design a suitable credit assessment system for credit market of SMEs according to a general situation of enterprises in the credit market and the SME's own characteristics from the factors of capital and credit.2. To build a systematic evaluation model and method of credit assessment system for SME credit markets by using the multi-level fuzzy comprehensive evaluation system in fuzzy mathematics, in order to achieve the goal of designing the rating system.

The result of this study can effectively improve the efficiency of commercial banks' credit risk management, and better guide China's commercial banks to support the SMEs' development.

II. THE FEATURES OF CREDIT ASSESSMENT OF SME CREDIT MARKET

The content of credit assessment for SME credit market is similar to that for a general corporation, but due to SMEs' own characteristics, the credit assessment for SME credit market should have the following features:

(1)Emphasis on the future status of SMEs. Once the SMEs grab the market opportunities, they will enjoy certain level of growth in a short period of time. Otherwise, they may be confronted with financial crisis immediately. Obviously, the management of SME faces has more volatile fluctuations with higher frequencies. Therefore, the credit assessment for SME credit market should focus on the future credit status of SMEs, with opportunities and challenges they are facing considered.

(2)Emphasis on the innovative capabilities of SMEs. Highly flexible mode of operation is one of the prominent advantages of SMEs, but it is not enough in the fierce competition in the economic market. Innovation already has

its decisive significance for SMEs surviving in today's highly competitive economic market, where knowledge economy plays a vital role. A corporation will not possess prompt development without innovation. Therefore, the credit assessment for SME credit market should focus on the innovative capabilities of SMEs.

(3)Emphasis on the growth of SMEs. Growth means the potential of the economic development. The credit of SMEs comes from the ability of future economic growth. SMEs should focus on innovation, but at the same time, paying attentions to the economic growth of innovative projects. They should try to develop the projects with less investment, less production time and immediate economic returns, namely "fast track" projects. And continuously transform the innovative achievement into productive forces and economic strength. Therefore, the credit assessment for SME credit market should focus on the growth of SMEs.

(4)Emphasis on the development status of SMEs. Development status refers to the broad prospects and sustainability of SME development, which can be explained from technical, economic and environmental aspects. Technically, development depends on whether an innovative technology can lead to further technical innovation, i.e. whether the technology is isolated or triggered. Triggered technology leads to better development [6]. Economically, development is the value of market expansion, whether ensures the market share of products. From the perspective of environmental aspects, the continuous development of new technologies is influenced by good environmental sense, it can be achieved through the environmental development; and sustainable development can only be achieved by being highly compatible with the economy and the environment [7]. Therefore, SMEs should pay attention to credit markets, credit assessment and the evaluation of SME development. The credit situation of medium enterprises depends on the development of small enterprises.

III. VALUE ANALYSIS OF FINANCE OPTION

The credit assessment system is mainly designed for independently owned SMEs, especially targeting their commodity production, exchange and business cooperation in various business transactions to fulfill commitments made to honor the situation and the extent of the full range of credit assessment, SMEs' credit directly determines the ability and willingness of SMEs to repay loans to commercial banks by cash flow. Therefore, a scientific and effective indicator system for commercial bank to facilitate credit decisions must be established. The indicator system should focus on two factors, capital and credit, including multi-angle, full consideration of the various aspects that have impact on SME credit. It should take both qualitative and quantitative approach so that the evaluation is scientific and objective. Next is to analyze the composition of the credit assessment indicator system of SME credit market.

A. The Financial Indicators

Financial indicators are the data obtained by the use of the basic concepts of finance and accounting and calculation of basic data from accounting books and statements that reflects the financial condition and related operating results. Historical indicator is calculated based on historical data; future indicator is calculated by using forecasted data; static indicator reflects the financial condition of a certain point of time; dynamic indicator reflects the operating results in a given time period. According to the reflected contents, financial condition indicator can be divided into:

(1) Credit capacity indicators. Credit capacity is the solvency of enterprises. Corporate debt is generally paid back using corporate assets under continuing operations, thus solvency indicator is typically represented by the ratio between assets and debt and assets liquidity, which is mainly reflected through asset-liability ratio, liquidity ratio, cash ratio , interest coverage indicators.

(2) Profitability indicators. Enterprises generally use financial returns to measure the profits. Corporate profits are obtained with the cash in flow to the enterprise, and the basis of making a profit is the increase in assets or equity. Thus, corporate profits and profitability is usually measured by the ratio between the profits and revenue, assets or equity, reflected mainly through sales profit margin, return on assets, operating cash flow.

(3) Operating capability indicator. Operating capacity is the ability of an enterprise to turn over its assets, which reflects the efficiency of business activities, and vitality. The main business activities of an enterprise are nothing but the production, supply and sale. If this process is smooth, the viability of the business is strong. Otherwise, it will have a significant impact on the solvency and profitability of enterprises. The main indicators that reflect the viability of an enterprise include the total asset turnover, inventory turnover, accounts receivable turnover, accounts payable turnover.

B. The Non-Financial Indicators

The non-financial indicators are indicators used to evaluate the state of corporate credit which are obtained from sources other than financial accounting system. This includes indicators from economy and past experiences. Non-financial indicators are necessary supplements to financial indicators. Due to the complexity of the production and operation activities and the credit assessment process, it's not sufficient to use sole financial indicators in the corporation credit assessment process. So following non-financial indicators act as a supplement to the corporation credit assessment system.

(1) Historical credibility of the target company. Indicator of the historical credibility of the target company evaluates the recognition of the historical credibility of the target company. It's mainly reflected by loan repay rates and Contract Compliance rates.

(2) Management capability of the target company. The capability of management of the company has significant influence on corporate credit. It's mainly reflected by funds management capability, quality management capability, technology management capability, information management capability as well as market management capability.

(3) Corporate environment. Company environment means macro environment in which the company is in, including political, economical, geographical, cultural and regulatory environment. They should play a significant role in the credit assessment system. The corporate environment indicators are reflected by industry policy stability, industry economic level and industry competitiveness.

(4) Leadership quality. The quality of leader directly affects the operation of corporate. It's mainly reflected by education level, business philosophy, business result and personal credit indicator.

(5) Innovation capability [8]. Obviously, evaluation to the innovation capability of the corporate will become a crucial part in corporate credibility assessment. It's generally reflected by technological innovation, human resource investment, material investment, financial investment benefit realization.

(6) Corporate prospect [9]. The future of a corporate is highly important in the corporate credibility assessment. Only a promising company will be promising. So the corporate prospect should be taken into consideration in the corporate credibility assessment. Corporate prospect is mainly reflected by industry policy, market share and profit forecast.

The above listed are main indicators for credit assessment indicator system of SME credit market, including not just qualitative and quantitative indicators, historical and future , as well as static and dynamic one. These indicators will generally and comprehensively reflect the operating environment and development prospect. However, no matter how rational the indicators are designed, each indicator can only present the condition of SME in certain area and be used as evidence in that perspective. In fact, SMEs' operation activities are complex and operation conditions varies. It's necessary to use multiple indicators with effective processing to generate an integrated evaluation to the corporate operation condition and result, and finally obtain a rational and accurate judgment and forecast to the SME future.

Faced by the SME credit market indicators of credit assessment system designed for discussion, this study gives the evaluation form by the 32 SME credit market indicator system of credit assessment system, as shown in Figure 3-1. In the figure, the SME credit market credit assessment system by the financial position of the indicator system and non-financial situation of two parts. Among them, the financial power of the part by the credit capacity, profitability, management ability composition of the basic factors, non-financial part of the historical credibility of the enterprise, business management, business environment, leaders of the quality, innovation, enterprise development prospects of the basic elements that form these factors constitute the main factors of the basic layer; and the main factor in the level of credit capacity, profitability, management ability track record, reputation, business management, business environment, leaders of the quality, innovation, enterprise development prospects included in the basic factors The reflective indicator, constitute the sub-element level. By discussing the design of the credit assessment system of for SME credit market, this study gives an indicator system formed by 32 indicators as shown in Figure 3-1.

IV. SME CREDIT MARKETS RATING SYSTEM AND EVALUATION MODEL

As the credit is essentially a comprehensive evaluation by a number of factors, SME credit markets are multi-level comp lex systems. SME credit is a typical problem of the ambiguity, it is difficult to make precise definition whether SME credit is good or bad, and by adopting the concept of fuzzy mathematics and fuzzy membership function, it helps to solve the problem. At the same time, it is consistent with the trend which applies the mathematical knowledge to the economic disciplines and the methods of quantitative analysis. With the application of computer technology, a lot of set operations are handled by the computers. Therefore, it is proposed to apply multi-level fuzzy mathematics of fuzzy comprehensive evaluation method as the main methods of credit assessment of the SME credit market. The SME credit market credit assessment system and evaluation model will be discuss below:

A. Establishment of Credit Assessment System in the Evaluation Indicator Set

Assume the SME credit market based credit assessment system for the evaluation indicator set is U , and $U=\{U_1,U_2\}$, U_1、U_2 is Sub-indicator of financial position and non-financial indicators of subsystem respectively which satisfy the condition that

$$U_1=\{U_{11},U_{12}U_{13}\}$$
$$U_2=\{U_{21},U_{22}U_{23},U_{24},U_{25},U_{26}\}$$

The general form of U_{ij} is $U_{ij}=\{U_{ij1},U_{ij2},...,U_{ijk}\}$,

And The specific form of U_{ij} is:

$$U_{11}=\{U_{111},U_{112},U_{113}\},$$
$$U_{12}=\{U_{121},U_{122},U_{123}\},$$
$$U_{13}=\{U_{131},U_{132},U_{133},U_{134}\}$$
$$U_{21}=\{U_{211},U_{212}\},$$
$$U_{22}=\{U_{221},U_{222},U_{223},U_{224},U_{225}\},$$
$$U_{23}=\{U_{231},U_{232},U_{233}\},$$
$$U_{24}=\{U_{241},U_{242},U_{243},U_{244}\},$$
$$U_{25}=\{U_{251},U_{252},U_{253},U_{254}\},$$
$$U_{26}=\{U_{261},U_{262},U_{263}\}.$$

B. Establishment of Credit Assessment System to Reviews the Value of a Collection

The credit assessment of SMEs is categorized into five levels: corresponding to the AAA level excellent), AA grade (very good), A-level (good), BB-level (average), B-class (poor). The principle for evaluating the 32 indicators which forms the basis of the evaluation is such that, qualitative indicators are obtained by expert evaluation, quantitative indicators are based on comparison with the established industry standards, expert evaluation method can be combined to determine with the industry standard too. Thus, the SME credit market assessment system to reviews the value of the collection is $V=\{V_1,V_2,V_3,V_4,V_5\}$.

C. Weightage of Various Indicators on the Credit Assessment System

The weightage of various indicators could be decided by professional judgment, If the weightage of U_{ijk} to U_{ij} is a_{ijk}, then

$A_{ij}=(a_{ij1},a_{ij2},...,a_{ijk})$, to be more specific:

$A_{11}=(a_{111},a_{112},a_{113})$,

$A_{12}=(a_{121},a_{122},a_{123})$,

$A_{13}=(a_{131},a_{132},a_{133},a_{134})$;

$A_{21}=(a_{211},a_{212})$,

$A_{22}=(a_{221},a_{222},a_{223},a_{224},a_{225})$,

$A_{23}=(a_{231},a_{232},a_{233})$,

$A_{24}=(a_{241},a_{242},a_{243},a_{244})$,

$A_{25}=(a_{251},a_{252},a_{253},a_{254})$,

$A_{26}=(a_{261},a_{262},a_{263})$.

Among which A_{ij} is the corresponding weight coefficient vector of the Sub-element level for the main element; the weight coefficient of U_{ij} to U_i is a_{ij}, and $A_1=(a_{11},a_{12},a_{13})$, $A_2=(a_{21},a_{22},a_{23},a_{24},a_{25},a_{26})$; A_i ($i=1,2$) is the corresponding weight coefficient vector of the Main-element level for the main element; the weight coefficient of U_i to U is a_i ($i=1,2$), and $A=(a_1,a_2)$, among which A is the weight coefficient vector of the index-level for the index factor.

D. Judging Subject Matrix in the Credit Assessment System

To every sub-level element's indicator U_{ijk}, the subject vector corresponded to the congregation V of the commentary value is:

$B_{ijk}=(b_{ijk1},b_{ijk2},b_{ijk3},b_{ijk4},b_{ijk5})$, in which $b_{ijkl}=\frac{V_{ijkl}}{n},l=1,2,3,4,5;n$ is the number of professionals that participate the assessment, V_{ijkl} is the number of experts who think that index U_{ijk} belongs to V_l level; from that we can derive the judging subject matrix of the sub-level: (as per normal):

$$B_{ij}=\begin{bmatrix}B_{ij1}\\B_{ij2}\\\vdots\\B_{ijk}\end{bmatrix}=\begin{bmatrix}b_{ij11}&b_{ij12}&b_{ij13}&b_{ij14}&b_{ij15}\\b_{ij21}&b_{ij22}&b_{ij23}&b_{ij24}&b_{ij25}\\\vdots&\vdots&\vdots&\vdots&\vdots\\b_{ijk1}&b_{ijk2}&b_{ijk3}&b_{ijk4}&b_{ijk5}\end{bmatrix}$$

E. Implementation of the Credit Assessment System and Fuzzy Comprehensive Evaluation

1) Comprehensive assessment of the Main Factors Layer

The sub-factors $\overline{B}_{ij}$ under the vector and matrices is corresponding weight coefficients of the main factors in the evaluation which is vector of the main factor in the membership layer.

It is proved that:

$$\overline{B}_{ij}=A_{ij}\cdot B_{ij}=(a_{ij1},a_{ij2},...,a_{ijk})\cdot\begin{bmatrix}b_{ij11}&b_{ij12}&b_{ij13}&b_{ij14}&b_{ij15}\\b_{ij21}&b_{ij22}&b_{ij23}&b_{ij24}&b_{ij25}\\\vdots&\vdots&\vdots&\vdots&\vdots\\b_{ijk1}&b_{ijk2}&b_{ijk3}&b_{ijk4}&b_{ijk5}\end{bmatrix}=(\overline{b}_{ij1},\overline{b}_{ij2},...,\overline{b}_{ijk})$$

C_{ij} Can be obtained by using the formula $c_{ijl}=\frac{\overline{b}_{ijl}}{\sqrt{\sum_{l=1}^{5}\overline{b}_{ijl}^{2}}}$ ($l=1,2,3,4,5$)

$C_{ij}=(c_{ij1},c_{ij2},c_{ij3},c_{ij4},c_{ij5})$, is the vector of evaluation under the matrix which Corresponding to the main factors in the membership layer:

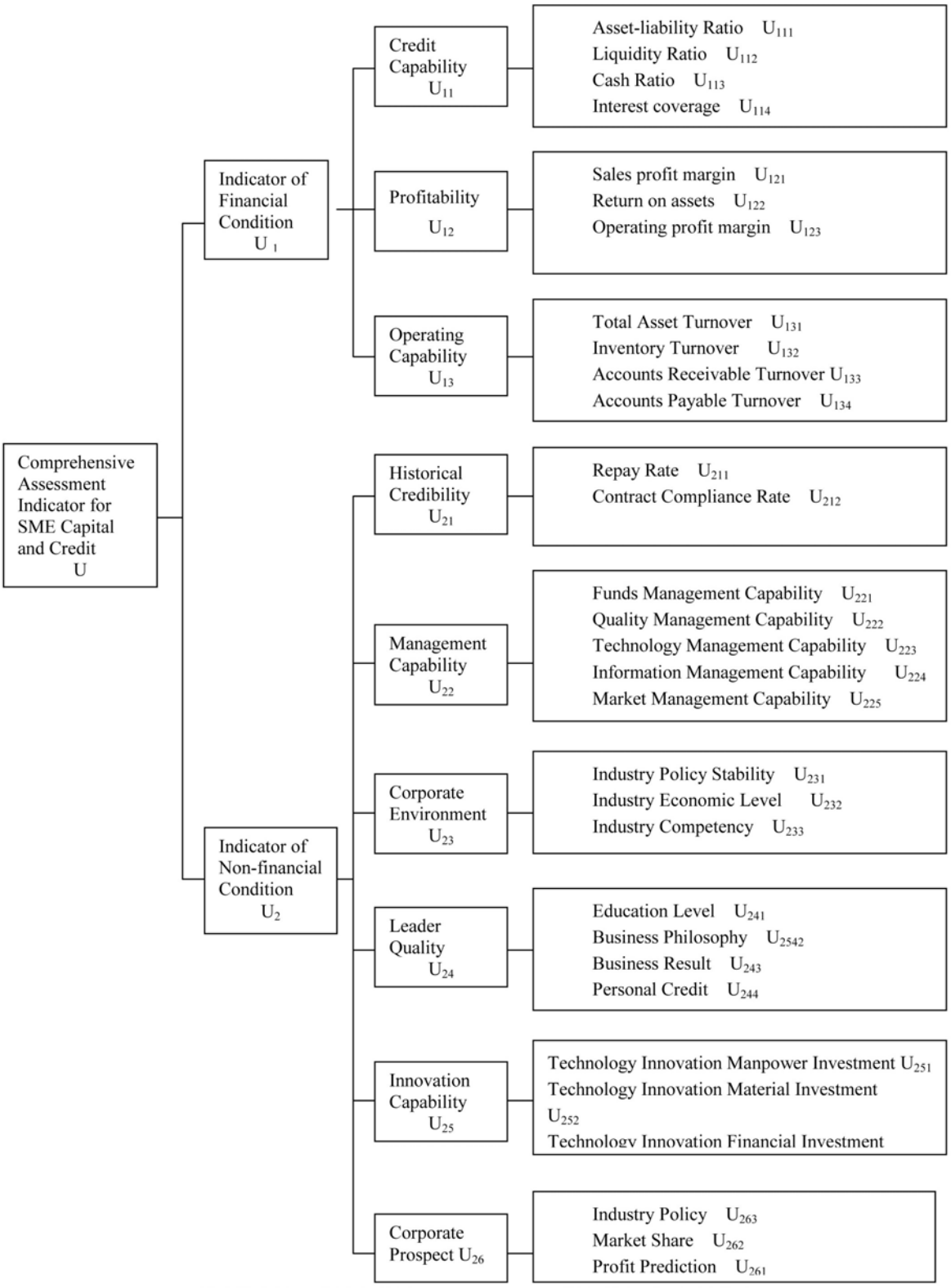
Comprehensive Assessment Indicator for SME Capital and Credit U
Indicator of Financial Condition U 1
Indicator of Non-financial Condition U2
Credit Capability U11
Asset-liability Ratio U111
Liquidity Ratio U112
Cash Ratio U113
Interest coverage U114
Profitability U12
Sales profit margin U121
Return on assets U122
Operating profit margin U123
Operating Capability U13
Total Asset Turnover U131
Inventory Turnover U132
Accounts Receivable Turnover U133
Accounts Payable Turnover U134
Historical Credibility U21
Repay Rate U211
Contract Compliance Rate U212
Management Capability U22
Funds Management Capability U221
Quality Management Capability U222
Technology Management Capability U223
Information Management Capability U224
Market Management Capability U225
Corporate Environment U23
Industry Policy Stability U231
Industry Economic Level U232
Industry Competency U233
Leader Quality U24
Education Level U241
Business Philosophy U2542
Business Result U243
Personal Credit U244
Innovation Capability U25
Technology Innovation Manpower Investment U251
Technology Innovation Material Investment U252
Technology Innovation Financial Investment
Corporate Prospect U26
Industry Policy U263
Market Share U262
Profit Prediction U261

Figure 3-1

$$C_i = \begin{bmatrix} C_{i1} \\ C_{i2} \\ \vdots \\ C_{ij} \end{bmatrix} = \begin{bmatrix} c_{i11} & c_{i12} & c_{i13} & c_{i14} & c_{i15} \\ c_{i21} & c_{i22} & c_{i23} & c_{i24} & c_{i25} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ c_{ij1} & c_{ij2} & c_{ij3} & c_{ij4} & c_{ij5} \end{bmatrix}$$

($i = 1,2$)

2) Comprehensive Assessment Indicator Layer

Similar to the above: $\overline{C_i} = A_i \cdot C_i = (\overline{c}_{i1}, \overline{c}_{i2}, ..., \overline{c}_{i5}) \cdot$, can be Standardized (normalized) by using the formula : $r_{il} = \dfrac{\overline{c}_{il}}{\sqrt{\sum_{l=1}^{5} \overline{C}_{il}^2}}$ ($l = 1,2,3,4,5$) to obtain the unit vector: $R_i = (r_{i1}, r_{i2}, r_{i3}, r_{i4}, r_{i5})$, R_i is the indicator corresponding to the membership vector which is the corresponding evaluation under the matrix:

$$R = \begin{bmatrix} R_1 \\ R_2 \end{bmatrix} = \begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} & r_{15} \\ r_{21} & r_{22} & r_{23} & r_{24} & r_{25} \end{bmatrix}$$

3) Composite Indicator Assessment

Similar to the above: $\overline{R} = A \cdot R = (\overline{r}_1, \overline{r}_2, ..., \overline{r}_5) \cdot$ can be Standardized (normalized) too using the formula $d_i = \dfrac{\overline{r}_l}{\sqrt{\sum_{l=1}^{5} \overline{r}_l^2}}$ to obtain the unit vector: $D = (d_1, d_2, d_3, d_4, d_5)$, D is the membership indicator vector of U to V.

4) Assessment of the Results of Treatment

Credit assessment of SMEs can be obtained using $d_l (l = 1,2,...,5)$ from the above. On the one hand, the principle of maximum membership can be adopted to determine Comprehensive evaluation conclusions, which is in accordance with the corresponding level of $\max\{d_l : l = 1,2,...,5\}$. On the other hand, in order to facilitate the comprehensive evaluation accuracy, values can be set on the reviews of levels corresponding to quantify $V = \{V_1, V_2, V_3, V_4, V_5\}$, and the final value of specific evaluation results is the obtained as $W = D \cdot V^T = \sum_{l=1}^{5} d_l V_l$, In general $V_l \in [0,100]$, and $d_l \in [0,1]$, Therefore, the final evaluation results is $W \in [0,100]$

V. Conclusion and Outlooks

In reality, often the majority of SMEs lack of mortgage assets, and only the large enterprises own adequate securities. However when the SMEs are in financing activities, the guarantee agencies will spend o lot on collecting information about the business activities, operation performance, financial position, and prospect and cash flow of the projects in the SMEs. And the cost will be added to SMEs, ultimately. Although the SMFIs, to some extent, alleviate the financing problem of SMEs, they also increase the cost of financing. And that will increase the risk of adverse selection and moral hazard, leading the financing institutions to become the ultimate bearers of financing risk. And to treat these financial guarantee risks, measures should be taken from two sides. First, from the external level, re-guarantee system for SME should be built quickly to transfer the risk of financing. From the internal level, internal control mechanisms should be built to prevent the occurrence of moral hazard of the manager.

The financial guarantee system for SME exists great system defects, limiting the healthy development of financial guarantee industry. This is a special high-risk industry, requiring healthy micro market environment, and commercial business model. From the perspective of market-oriented economy, even the government funded financial guarantee agencies will transfer to company structure. Adhering to market operation is the guarantee for the sustainable development of financial agencies and it also is a rule of improving the financial guarantee system for SMEs in our nation. Concerning of the way to inducing private capital to financial guarantee industry, and realizing the mutual development of policy guarantee, mutual guarantee, and commercial guarantee agencies, the study deserve to be deepen and developed, which will contribute to solve the function defects, which is caused by structural defects.

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